Code: 19A54202

B.Tech I Year II Semester (R19) Regular Examinations November 2020

PROBABILITY & STATISTICS

(Common to CSE, IT & FT)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

Statistical tables are permitted.

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define population and sample.

(b) Explain measures of variability.

(c) If A and B are any events in S then prove that:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B).$$

(d) If the Probability density of a random variable is given by:

$$f(x) = \begin{cases} k\,x^2 & 0 < x < 1 \\ 0 & elsewhere \end{cases}$$

Find the value of k.

(e) Find the mean of Poisson distribution.

(f) Define the normal distribution.

(g) Define Type-I and Type-II errors in testing of hypothesis.

(h) Explain briefly the following: (i) Null hypothesis. (ii) Alternative hypothesis.

(i) Write statistic for testing of equality of variances.

(j) Write χ^2 statistic for test of goodness of fit.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Explain the following: (i) Collection of data. (ii) Primary and secondary data.

(b) By the method of least squares, find the straight line that best fits the following data:

x	1	3	4	6	8	9	11	14
y	1	2	4	4	5	7	8	9

OR

3 (a) Explain the following: (i) Measures of central tendency. (ii) Skewness and Kurtosis.

(b) Obtain the correlation coefficient for the following data :

x	48	60	72	62	56	40	39	52	30
y	62	78	65	70	38	54	60	32	31

UNIT – II

4 (a) (i) Define probability of an event. Write the axioms of probability.

(ii) What is the probability of getting a total of 8 or 10 when a pair fair dice are tossed?

(b) Two cards are drawn at random from an ordinary deck of 52 playing cards. What is the probability of getting two aces if: (i) The first card is replaced before the second card is drawn. (ii) The first card is not replaced before the second card is drawn.

OR

5 (a) Suppose three companies X, Y, Z produce T.V's. X produce twice as many as Y while Y and Z produce the same number. It is Known that 2% of X, 2% of Y and 4% of Z are defective. All the TV's produced are put into one shop and then one TV is chosen at random.

(i) What is the probability that the TV is defective?

(ii) Suppose a TV chosen is defective, what is the probability that this TV is produced by company X?

(b) A discrete random variable X has the following probability distribution given below:

Value of X	0	1	2	3	4	5	6	7
$P(X=x)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$

(i) Find the value of 'k'. (ii) Find $P(X<6), P(0<X<4)$ and $P(X \geq 6)$.

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UNIT – III

6 (a) Define binomial distribution and find its mean.
(b) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.

OR

7 (a) Out of 800 families with 5 children each, how many would you except to have: (i) 3 boys. (ii) Either 2 or 3 boys? (iii) 5 girls. Assume equal probabilities for boys and girls.
(b) Find the probabilities that a random variable having the standard normal distribution will take on a value: (i) Between 0.87 and 1.28. (ii) Between – 0.87 and 0.62. (iii) Greater than 0.85. (iv) Greater than – 0.65.

UNIT – IV

8 (a) Explain the test procedure for Z – test concerning difference between two means.
(b) An urban community would like to show that the incidence of breast cancer is higher than in a nearby rural area. If it is found that 20 of 200 adult women in the urban community have breast cancer and 10 of 150 adult women in the rural community have breast cancer, can we conclude at the 0.01 level of significance that breast cancer is more prevalent in the urban community?

OR

9 (a) Determine a 95% confidence interval for the mean of a normal distribution with variance $\sigma^2 = 0.25$, using a sample of $n = 100$ values with mean $\overline{x} = 212.3$.
(b) A company claims that its light bulbs are superior to those of its main competitor. If a study showed that a sample of $n_1 = 40$ of its bulbs has a mean life time of 1647 hours of continuous use with a standard deviation of 27 hours, while a sample of $n_2 = 40$ bulbs made by its main competitor had a mean lifetime of 1638 hours of continuous use with a standard deviation of 31 hours, does this substantiate the claim at the 0.05 level of significance?

UNIT – V

10 (a) The following values given the lengths of 12 samples of Egyptian cotton taken from a shipment : 48,46,49,46,52,45,43,47,47,46,45,50. Test if the mean length of the shipment can be taken as 46. Use a 0.05 level of significance.
(b) A study is conducted to compare the length of time between men and women to assemble a certain product. Past experience indicates that the distribution of times for both men and women is approximately normal but the variance of the times for women is less than that for men. A random sample of times for 11 men and 14 women produced the following data:

Men	Women
$n_1 = 11$	$n_2 = 14$
$s_1 = 6.1$	$s_2 = 5.3$

Test the hypothesis that $\sigma_1^2 = \sigma_2^2$ against the alternative that $\sigma_1^2 > \sigma_2^2$. Use 0.05 level of significance.

OR

11 (a) Two samples of sodium vapor bulbs were tested for length of life and the following results were returned :

	Size	Sample mean	Sample S.D.
Type I	8	1234 hrs	36 hrs
Type II	7	1036 hrs	40 hrs

Is the difference in the means significant to generalize that type I is superior to type II regarding length of life? Use a 0.05 level of significance.
(b) Explain the test procedure for small sample test concerning difference between two means.

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B.Tech I Year II Semester (R19) Supplementary Examinations April 2021

PROBABILITY & STATISTICS

(Common to CSE, IT & FT)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define primary and secondary data.

(b) State principle of least squares.

(c) If A^c is the complement of A then prove that $P(A^c) = 1 - P(A)$.

(d) Given the probability density function of a random variable X as:

$f(x) = \frac{k}{x^2+1}$, $-\infty < x < \infty$, find k.

(e) Define the normal distribution.

(f) Define Poisson distribution.

(g) Explain briefly the following: (i) Left one tailed test. (ii) Right one tailed test.

(h) Define point estimator and unbiased estimator.

(i) Find the value of $F_{0.99}$ for $v_1 = 6$ and $v_2 = 20$ degrees of freedom.

(j) Write χ^2 statistic for analysis of $r \times c$ table.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Explain the following: (i) Population and sample. (ii) Skewness and Kurtosis.

(b) Fit a Straight line $y = a + bx$ to the following data by the method of least squares:

x	0	1	3	6	8
y	1	3	2	5	4

OR

3 (a) Explain the following: (i) Measures of variability. (ii) Rank correlation and Regression coefficients.

(b) Calculate correlation coefficient to the following data:

x	10	15	12	17	13	16	24	14	22	20
y	30	42	45	46	33	34	40	35	39	38

UNIT – II

4 (a) If A and B are any events in S then prove that:

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

(b) If the probability that a communication system will have high fidelity is 0.81 and the probability that it will have high fidelity and high selectivity is 0.18. What is the probability that a system with high fidelity will also have high selectivity?

OR

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(a) Suppose colored balls are distributed in three indistinguishable boxes as follows :

	Box I	Box II	Box III
Red	2	4	3
White	3	1	4
Blue	5	3	3
Total	10	8	10

A box is selected at random from which a ball is selected at random. What is the probability that the ball is red?

(b) A discrete random variable X has the following probability distribution

Value of X	1	2	3	4	5	6	7	8
$P(X=x)$	$2k$	$4k$	$6k$	$8k$	$10k$	$12k$	$14k$	$4k$

(i) Find the value of 'k'. (ii) Find $P(X<3)$ and $P(X \geq 5)$. (iii) Find the distribution function of X.

UNIT – III

6 (a) Define Poisson distribution and find its mean.

(b) A sample of 100 dry battery cells tested to find the length of life produced the following results:
$\bar{x}$ = 12 hours, σ = 3 hours.
Assuming the data to be normally distributed, what percentage of battery cells are expected to have life: (i) More than 15 hours. (ii) Less than 6 hours. (iii) Between 10 and 14 hours?

OR

7 (a) Define Binomial distribution and find its variance.

(b) In a normal distribution, 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution?

UNIT – IV

8 (a) Explain the test procedure for large sample test concerning difference between two proportions.

(b) A manufacturer claims that the average tensile strength of thread A exceed the average tensile strength of thread B by at least 12 kilograms. To test his claim, 50 pieces of each type of thread are tested under similar conditions. Type A thread had an average tensile strength of 86.7 kilograms with known standard deviation of $\sigma_A = 6.28$ kilograms, while type B thread had an average tensile strength of 77.8 kilograms with known standard deviation of $\sigma_B = 5.61$ kilograms. Test the manufacturers claim at 0.01 level of significance.

OR

9 (a) A study shows that 64 of 180 persons who saw a photocopying machine advertised during the telecast of a baseball game and 75 of 180 other persons who saw it advertised on a variety show remembered the brand name 2 hours later. Use the Z-statistic to test at the 0.05 level of significance whether the difference between the corresponding sample proportions is significant.

(b) Determine a 99% confidence interval for the mean of a normal distribution with variance σ^2 = 9, using a sample of $n=100$ values with mean $\bar{x}=5$.

UNIT – V

10 (a) The specifications for a certain kind of ribbon call for a mean breaking strength of 180 pounds. If five pieces of the ribbon have a mean breaking strength of 169.5 pounds with a standard deviation of 5.7 pounds, test the null hypothesis $\mu = 180$ pounds against the alternative hypothesis $\mu < 180$ pounds at the 0.01 level of significance. Assume that the population distribution is normal.

(b) Explain the test procedure for small sample test concerning difference between two means.

OR

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11 To determine whether there really is a relationship between an employee's performances in the company's training program and his or her ultimate success in the job, the company takes a sample of 400 cases from its very extensive files and obtains the results shown in the following table:

		Performance in training program			
		Below Average	Average	Above Average	Total
Success in job (employer's rating)	Poor	23	60	29	112
	Average	28	79	60	167
	Very good	9	49	63	121
	Total	60	188	152	**400**

Use the 0.01 level of significance to test the null hypothesis that performance in the training program and success in the job are independent.

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